

January 7, 1958

Dr. René J. Dubos
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New York 21, N. Y.

Dear Dr. Dubos:

I am going to be delighted to read your discussion on benevolent virology. I wish I could be of more help to you on it than I am likely to be.

I have not been able to think of any very clear cut examples involving virus-mammal symbiosis. This topic is of course tied in with the whole story of latent viruses, about which you probably know more than I do. The only beneficial functions of virus infection in mammals that could be included by any stretch of the imagination would seem to be those related to immunity to related viruses. Of course one thinks here of the story with lymphocytic choriomeningitis in mice (Fraub, 1938, Journal of Experimental Medicine). I think that McDowell also had evidence for a plasmid (virus?) that reduced the incidence of leukemia in certain strains of mice. These examples are of course rather far fetched. However as we know so little about the physiology of germ-free animals we can hardly think to have a clear grasp of the situation. Indeed one can easily imagine the technical difficulties in diagnosing a beneficial virus in mammals. Except under extraordinary circumstances evolutionary pressure would all be in favor of the ubiquitous occurrence of such a virus and we would have no means of perceiving its effects without special techniques. When and if we develop antibiotics which have a high degree of effectiveness for viruses we may expect some surprises in this direction.

Some of the questions you asked about are covered in my paper in Physiological Reviews, 1952, and in the article "Infection and Heredity" which appeared in the 14th Growth Symposium. I will send you a copy of this under separate cover. However I am ~~worry~~ sorry that I did not take the opportunity in the "Viruses, Genes and Cells" article to cite the excellent review written by Anton Koch (1956, "The Experimental Elimination of Symbionts and its Consequences", Experimental Parasitology, 5:481-518). This is one of the best reviews to come from the Buchner School. I do hope you are well acquainted with the 1953 edition of his monograph.

The communication between Buchner's School and the geneticists has not been all it ought to be and there are a couple of other very interesting examples that have been approached mainly from the genetical standpoint. There is of course Sonneborn's study of Paramecium in which the presence of the plasmid kappa confers immunity on the corresponding antibiotic paramycin. A possibly similar story has been reported for racial crosses of mosquitoes wherein the inheritance of a certain plasmid from the mother protects an egg against fatal infection by the same agent or its product if introduced by the

Page 2 - January 7, 1958

sperm, (H. Laven, "Reziprok unterschiedliche kreuzbarkeit von stechmücken (culicidae) und ihre deutung als plasmatische vererbung", Z. Vererbungslehre, 85: 118-136 (1953)).

In this type of discussion I have hardly found it possible to maintain a meaningful distinction between viruses and plasmogenes, and for this reason have resorted to the expression "plasmid" in order not to waste time on that particular issue.

If I can be of any further help in tracing or interpreting equally far fetched examples, please let me know.

Yours sincerely,

Joshua Lederberg
Professor of Medical Genetics

JL/ew